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memorandum

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to San Joaquin River Tributaries Settlement Process – Science Team

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subject Stanislaus River - SMART Objectives for Conservation Actions

In a separate memorandum, we have provided a draft of an assessment of limiting factors to the natural production of fall-run Chinook salmon and steelhead in the Stanislaus River for your review and comment (see also Table 1 below). That memorandum also elucidates the key process "drivers" (physical and ecological processes like floodplain inundation, bed scour, and pulse flows), examines how those drivers influence the limiting factors, and how river management and anthropogenic disturbance have impaired many of those drivers.

Table 1. Summary of Critical Limiting Factors for Fall-run Chinook Salmon and Steelhead

Parameter	Location	Limiting Factor	Cause	Process
Adult Upstream Migration				
Instream flows	Goodwin Dam to San Joaquin River	-Muted pulse flows and migration cues	-Reservoir operations	-Altered flow regime
Spawning				
Gravel quantity	Goodwin Dam to Riverbank	-Reduced spawning habitat area -Redd superimposition	-Dredging -Dam construction -Channel encroachment	-Channel morphology altered and areas reduced -Sediment supply recruitment reduced/stopped
Gravel quality	Goodwin Dam to Riverbank	-Armored riffles -Gravel embeddedness -Redd superimposition	-Dam construction -Reservoir operations	-Sediment recruitment reduced/stopped -Altered flow regime
Egg Incubation and Emergence				
Gravel quantity	Goodwin Dam to Riverbank	-Reduced incubation habitat area -Redd superimposition	-Dredging -Dam construction -Channel encroachment	-Channel morphology altered and areas reduced -Sediment supply recruitment reduced/stopped
Gravel quality	Goodwin Dam to Riverbank	-Armored riffles -Gravel embeddedness -Redd superimposition	-Dam construction -Reservoir operations -Stormwater runoff	-Sediment recruitment reduced/stopped -Altered flow regime
Juvenile Rearing				
Space, refuge from predators, and food availability	Entire lower Stanislaus River below Goodwin Dam	-Predation -Reduced floodplain habitat -Reduced food availability	-Nonnative species introductions -Altered channel morphology -Channel	-Habitat modifications/ species interactions -Sediment recruitment reduced/stopped -Altered flow regime

			encroachment -Reservoir operations	
Juvenile Outmigration				
Instream flows	Goodwin Dam to San Joaquin River	-Muted pulse flows and migration cues corresponding with freshettes	-Reservoir operations	-Altered flow regime
Space, refuge from predators, and food availability	Entire lower Stanislaus River below Goodwin Dam	-Predation -Reduced floodplain habitat -Reduced food availability	-Nonnative species introductions -Altered channel morphology -Channel encroachment -Reservoir operations	-Habitat modifications/ species interactions -Sediment recruitment reduced/stopped -Altered flow regime

In order to address limiting factors, a suite of conservation actions and/or integrated projects (sets of actions) will be developed, with that work expected to occur in autumn 2013. At this time, a set of objectives are being developed that, when evaluated after implementation of the conservation actions/projects, will allow identification and evaluation of how the goals of the Settlement Process (listed below) are being addressed. These objectives are 'categorical' at this time, and are not fully enumerated. The draft objectives will be reviewed subsequent to development and agreement of the conservation projects in Phase 2 of the Settlement Process, with specific enumeration of each objective, and any relevant refinements, made at that time.

Objectives should be SMART: specific, measurable, agreed upon, realistic and time-based. Development of such SMART Objectives should consider the following questions and provide answers or hypotheses in response:

Specific:

- What is the specific action or task?
- Is it clear and well defined?
- Is it clear to anyone that has a basic knowledge of the work area?

Measureable:

- What are the standards, metrics and parameters?
- Is the objective obtainable and how far away is completion?
- Is there a target time/duration in which it has to be achieved?

Achievable:

- Is the task achievable?
- Is there agreement with all the stakeholders on the objective?

Realistic:

- Are sufficient resources available?

- Is there sufficient knowledge and time to achieve task?

Time Bound:

- What are the start and end dates?
- Is there enough time to achieve the goal?

Assumptions

The various parties agreed to assume survival and/or mortality loss rates in the Delta and ocean is not under control of those in the Settlement Process, and the process of setting SMART objectives is aimed at determining how the various conservation actions are doing in terms of achieving the goals specifically associated with the lower Stanislaus River.

Goals

The following presents the proposed Settlement Process goals (as received through February 25, 2013). Development and implementation of conservation actions/projects is in response to meeting these goals, with a specific focus on addressing key limiting factors (addressed separately).

Fishery Agency/NGO Proposed Goals[1]

1. In concert with the San Joaquin River Restoration Program and its supporting settlement agreement, establish and maintain independent viable populations of native migratory fish species on each major tributary of the San Joaquin River in a manner that complies with the fish doubling mandate, Endangered Species act (ESA) Recovery mandates and allows for commercial, recreational and indigenous harvest of the fishes.
2. Establish healthy, self-sustaining native aquatic and riparian communities throughout the San Joaquin watershed.
3. Manage the hydrograph of the Stanislaus, Merced, Tuolumne and lower San Joaquin rivers in a manner that provides a greater overall magnitude of flow and mirrors natural, unregulated flows in frequency, timing, and duration.
4. Establish functional, self-sustaining corridors of floodplain, instream channel, and riparian habitats from the upper watershed through the southern Delta in a manner that supports resident and migratory fish populations, supports the goals of the State's new flood management plan[2] and is consistent with any complementary BDCP actions.
5. Develop additional water system flexibility and efficiency to help avoid and/or minimize future disruption of water supply and to help mitigate effects of desired ecosystem flow improvements.
6. Provide safe, timely, and effective fish passage around or through migration barriers for the

1 These goals are for aquatic ecosystem resources only and are not intended to be inclusive of the goals for all resource areas that may be addressed in the course of future regulatory or environmental compliance processes. In achieving these goals, we want to maintain and build collaboration among the stakeholders, continue outreach to others, and develop and implement comprehensive and collaborative monitoring and adaptive management programs that are scientifically based.

2 Central Valley Flood Protection Plan (CVFPP)

purpose of establishing, or contributing to long-term, independent and viable populations of native salmonids

SJTA Proposed Goals

7. Maintain reliable water supply delivery sufficient to sustain regional self-sufficiency and promote the economic vitality of agricultural, municipal and industrial users.
8. Sustain groundwater basin levels sufficient to maintain existing groundwater contour levels, gaining rivers, and groundwater quality.
9. Provide sufficient water to maintain sustainable hydropower generation, capacity, and/or ancillary services.
10. Enable the major reservoirs on the Stanislaus, Tuolumne and Merced Rivers to be operated on a sustainable basis over the long-term considering year-to-year hydrological fluctuations, which may be exacerbated by climate change, and considering the multiple beneficial uses for which these reservoirs are operated.

Draft SMART Objectives

The following are draft SMART objectives that address assessment of conservation projects to increase natural production of fall-run Chinook salmon and steelhead on the Stanislaus River. These include:

1. **Increase abundance: Increase the 10-year running-annual average of natural production to *XXXXX* adult fall-run Chinook salmon and *YYYYY* adult steelhead.**

Key Component	Objective
Specific - What is the specific task?	*Increase production, measured as escapement, as detailed in the objective.*
Measurable - What are the standards or parameters?	*Natural production of anadromous fish in the Stanislaus River will be sustainable on a long-term basis, as detailed in the objective. Annual estimate includes escapement, harvest, consideration of ocean and Delta conditions, and is to be adjusted for any hatchery contributions. Measurement will be via redd and carcass surveys.*
Achievable - Is the task feasible?	*The Science Team has identified that the populations of these fishes are limited because of redd superimposition and decreased juvenile survival during outmigration. Increasing overall production is an agreed objective by the settling parties.*
Realistic - Are sufficient resources available?	*The actions necessary to meet this objective are relatively-well understood, and the parties have agreed to implement the measures necessary to achieve this objective. It is realistic that this objective can be attained.*
Time-Bound - What are the start and end dates?	*Because it is measured as 10-year running-annual average, the objective will not be met immediately; however, an increase in the trending of this objective should be visible after sufficient implementation has occurred and the returning cohorts are measured. Some of these activities (such as sediment augmentation) would be in perpetuity, and thus measurement of this objective would continue.*

2. Increase10-year running-annual average of egg-to-juvenile survival for fall-run Chinook salmon and steelhead.

Key Component	Objective
Specific - What is the specific task?	*Increase the survival of Chinook salmon and steelhead in the egg-to-juvenile life stages.*
Measurable - What are the standards or parameters?	*The parameters used to estimate egg-juvenile survival rates have been and can continue to be accurately measured. Egg-to-juvenile survival rates can be calculated using estimates of potential egg deposition (number of adult females * number of eggs per female) and estimates of juvenile abundance from rotary screw trap monitoring. Baseline egg-to-juvenile survival rates (i.e., juvenile production) have been calculated from available adult fall-run Chinook salmon abundance data from the Stanislaus River weir (2003-2011) and from carcass surveys (1997-2002); average fecundity of 5,000 eggs per female (Kaufman et al. 2009) and available juvenile fall-run Chinook salmon abundance data from the Oakdale rotary screw trap (1998-2012). Mean egg-to-juvenile survival for the available baseline period, Brood Years 1998 through 2010 was 11%, and ranged from 7% to 19% (Table 2).*
Achievable - Is the task feasible?	*Because limiting factors such as redd superimposition are to be addressed via spawning habitat augmentation (i.e., increasing spawning habitat quality and quantity), it is reasonable to assume that this objective is achievable.*
Realistic - Are sufficient resources available?	*The implementation of spawning habitat augmentation projects is feasible and proven. Ongoing monitoring will allow for measurement of this objective, and the settling parties are supporting the measures to address key limiting factors that influence this objective. Thus, it is reasonable to assume that this objective is realistic.*
Time-Bound - What are the start and end dates?	*Measurement to assess this objective would begin once implementation of conservation measures designed to increase spawning and rearing habitat and to increase juvenile production are completed. Some of these activities (such as sediment augmentation) would be in perpetuity, and thus measurement of this objective would continue. Measurement would run for a minimum of 10 years.*

Table 2. Annual Baseline Estimates of Fall-Run Chinook Salmon Egg-To-Juvenile Survival in the Stanislaus River for Brood Years 1998 to 2010

Brood Year (spawning year)	Estimated # Females	Estimated # Eggs (5,000 per female)	Egg-to-Juvenile Survival
1998	1,513	7,563,150	19%
1999	2,175	10,872,500	18%
2000	5,328	26,641,230	4%
2001	4,269	21,345,155	7%
2002	4,688	23,438,870	7%
2003	2,880	14,398,560	11%
2004	1,506	7,531,900	13%
2005	2,216	11,079,100	11%
2006	1,818	9,088,150	15%
2007	230	1,149,600	8%
2008	462	2,307,500	8%
2009	508	2,540,400	16%
2010	638	3,189,550	12%
		Average	**11%**

3. **Increase 10-year running-annual average of survival of fall-run Chinook salmon and steelhead smolts moving into the Delta.**

Key Component	Objective
Specific - What is the specific task?	*Implement conservation actions that increase the survival of Chinook salmon and steelhead smolts outmigrating from the lower Stanislaus River.*
Measurable - What are the standards or parameters?	*Survival of migrating, naturally produced fall-run Chinook salmon and steelhead smolts can be estimated as the ratio of estimated abundance at the lower rotary screw trap at Caswell to the upper rotary screw trap at Oakdale.*
Achievable - Is the task feasible?	*Because the conservation actions necessary to increase survival of juveniles in the river will be directed towards rearing and outmigration survival and there are proven actions to improve these conditions, it is reasonable to assume that this task is achievable. It is feasible to complete the monitoring necessary to measure the objective because much of it is already ongoing.*
Realistic - Are sufficient resources available?	*As noted above, this objective is realistic because the actions it considers are being implemented and it utilizes ongoing monitoring as the basis for assessment.*
Time-Bound - What are the start and end dates?	*Measurement to assess this objective would begin once implementation of conservation actions designed to increase spawning and rearing habitat and to increase juvenile production are completed. Measurement would run for a minimum of 10 years.*

4. **Increase life history diversity:**
    a. **Life history strategy: Achieve the following distribution of fall-run Chinook salmon life history strategies: XX% fry, YY% par, and ZZ% smolt (USBR, unpublished data).**
    b. **Age structure for fall-run Chinook salmon: XX% two year; YY% three year; and ZZ% four year (Marston and Mesick 2007).**

Key Component	Objective
Specific - What is the specific task?	*Complete conservation actions that result in greater spatial and temporal distribution of spawning and rearing opportunities for Chinook salmon and steelhead, such that the life histories of these populations is diversified as compared to existing conditions.*
Measurable - What are the standards or parameters?	*The timing of juvenile outmigration (from rotary screw trap monitoring) will be used to categorize life history strategies (fry, smolt, parr) and weir and carcass survey data (along with requisite tagging already implemented) will be used to assess age structure of retuning adults.*
Achievable - Is the task feasible?	*Because the conservation measures necessary to allow for diversification of life history strategies can be achieved by managing for different life stages, it is reasonable to assume that this task is achievable. It is feasible to complete the monitoring necessary to measure the objective because much of it is already ongoing.*
Realistic - Are sufficient resources available?	*As noted above, this objective is realistic because the actions it considers are being implemented and it utilizes ongoing monitoring as the basis for assessment.*
Time-Bound - What are the start and end dates?	*Measurement to assess this objective would begin once implementation of conservation measures designed to increase spawning and rearing habitat and to increase juvenile production are completed. Some of these activities (such as sediment augmentation) would be in perpetuity, and thus measurement of this objective would continue. Measurement would run for a minimum of 10 years.*